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ABSTRACT

This manual provides curriculum materials for implementing a career exploration class in transportation occupations within a Practical Arts Education program for middle/junior high school students. Introductory materials include the program master sequence, a list of transportation occupations (land, water and aerospace transportation families), an overview of the competency-based instructional system for practical arts, and a narration for a slide-tape presentation. The instructor's guide to learning activities contains guide sheets for each task assignment sheet; these guide sheets present objectives, attitudes and values to be developed, one or more checkout activities, recommended references and audiovisuals, notes and suggestions for instruction, and references and necessary tools and equipment. Master copies of learning activities are included. Appendixes include lists of vocabulary, practical arts videotapes, references appropriate for career exploration, and ideas for addressing students with special needs. The 12 student task assignment sheets are also included. Each contains these components: an introduction, objectives, learning activities, checkout activities, vocabulary, instruction sheets, and a copy of the instructor's final checklist. The tasks focus primarily on auto mechanics and include such activities as disassembling, repairing, reassembling and maintaining two- and four-cycle engines. (YLB)

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PRACTICAL ARTS

Transportation Exploration

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1983

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[Student Task Assignment Sheets]

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PROGRAM MASTER SEQUENCE

PRACTICAL ARTS
Transportation Exploration

CODE NUMBER	TITLE	MODULE STOCK NUMBER	SLIDE STOCK NUMBER	TAPE STOCK NUMBER
PA-TR	Overview of Transportation		6-321	6-322
PA-TR-1	Identify Energy Sources	6-323		
PA-TR-2	Identify Simple Machines	6-324		
PA-TR-3	Demonstrate Use of Simple Machines	6-325		
PA-TR-4	Identify Advantages and Disadvantages of Friction	6-326		
PA-TR-5	Use Lubricants to Overcome Friction	6-327		
PA-TR-6	Identify Basic Systems of a Four-Cycle Engine	6-328		
PA-TR-7	Identify Tools Used in Maintaining Engines	6-329		
PA-TR-8	Disassemble a Two- or Four-Cycle Engine	6-330		
PA-TR-9	Measure and Evaluate Parts and the Condition of Engines	6-331		
PA-TR-10	Reassemble a Two- or Four-Cycle Engine	6-332		
PA-TR-11	Test Run a Two- or Four-Cycle Engine	6-333		
PA-TR-12	Make External Adjustments on a Two- or Four-Cycle Engine	6-334		

TRANSPORTATION OCCUPATIONS

Land Transportation Family

- Mechanic
- Body and Fender Specialist
- Brake Specialist
- Diagnostic Specialist
- Electrical Specialist
- Front End Specialist
- Air Conditioning Specialist
- Truck Driver
- Bus Driver
- Transmission Specialist
- Tune-Up Specialist
- Parts Specialist
- Service Manager
- Shop Foreman
- Railroad Engineer
- Railroad Brake Coupler
- Railroad Conductor

Water Transportation Family

- Boatswain
- Lock Tender
- Deck Cadet
- Barge Captain
- Stevedore
- Deckhand
- Quartermaster
- Able Seaman
- Marine Oiler
- Ferryboat Operator
- Sounder
- Tugboat Dispatcher

AEROSPACE TRANSPORTATION FAMILY
Airline Workers

Flight Operations Jobs

- Pilot
- Copilot
- Flight Engineer
- Flight Attendant

Ground Operations Jobs

- Control Tower Operator
- Air Traffic Operator
- Meteorologist
- Teletypist

Sales and Office Jobs

- Reservation Agent
- Ticket Agent
- Computer Personnel
- Public Relations Director
- Accountant
- Switchboard Operator
- Secretary
- Receptionist

Ground Crew Jobs

- Ramp Service Worker
- Ramp Planner
- Cargo and Freight Loader
- Load Planner

Maintenance Jobs

- Airline Maintenance Inspector
- Airframe and Power Plant (Engine) Mechanic
- Instrument Technician
- Radio Technician
- Propeller Specialist
- Electric and Radio Assembler
- Aircraft Welder
- Aircraft Fabric Specialist
- Machinist
- Sheet-Metal Worker
- Carpenter
- Electrician
- Painter

Professional Jobs

- Aeronautical Engineer
- Aircraft Engineer
- Nurse and Doctor
- Flight Instructor
- Lawyer

Space Program Workers

- Aeronautical Design Engineer
- Aeronautical Engineer
- Aeronautical Test Engineer
- Aerodynamist
- Electronics Engineer
- Research Mechanic
- Stress Analyist
- Weight Analyist
- Sales Engineer

Conveyor Family

- Pumping Supervisor
- Field-Pipe-Lines Supervisor
- Coal-Pipe-Line Operator
- Pumper
- Pumper Helper
- Gager
- Barrel Filler
- Pipe-Lines Laborer
- Crane Operator
- Elevator Operator
- Warehouse Receiving Clerk

Overview of Program

The purpose of the Practical Arts Education program is to broaden the experiences of middle/junior high school students by providing them with an opportunity to become oriented to the world of work and explore a diversity of career goals in order that they may be better prepared to make decisions on their personal needs and future goals. The Practical Arts program consists of a series of career exploration classes based on the occupational clusters spread over a two-year period. A cruise through each occupational cluster shall include the implementation of three behavioral components or domains.

(A) Cognitive: Students shall survey or cruise the content of the occupational cluster. This survey should include the scope, levels, working conditions, entry requirements, duties performed, opportunities, and related jobs in the occupational cluster.

(B) Psychomotor: Students shall have in each cluster experiences of tasks that will be the same as or similar to those who work in the occupational cluster. These experiences or tasks shall be action oriented, vary with the students' interests, aptitudes, and abilities, and be at various levels of employment within a cluster.

(C) Affective: Students shall receive guidance and the opportunity to systematically apply those knowledges and experiences within the cluster to his/her own interest and soilities, his/her present and future choices, and future occupational decisions and experiences.

The competency-based vocational education curriculum is specifically directed at the psychomotor, activities, experience, or tasks aspect of the Practical Arts program. Teachers are encouraged to augment their lesson plans with cognitive information about the occupational clusters from other sources. The curriuclum here will help specifically in the psychomotor aspect of the program.

Competency-Based Vocational Education

The purpose of this manual is to aid the instructor in implementing a competency-based instructional program. It is intended as a guide and resource for the teacher using CBVE materials. The materials in any occupational area have several common elements, particularly their purpose and their format, which will be discussed later.

Regardless of the delivery system used to implement it, CBVE is based on the concept of competencies. That is to say, it is an instructional system in which: (1) the competencies for specific occupations are built around tasks validated by incumbent workers; (2) instruction is designed around performance objectives based on the worker tasks; (3) students are held accountable for meeting the specified minimum standards of performance required for entry-level jobs.

These instructional materials have been developed by Kentucky teachers. They have attempted to provide relevant learning activities and performance objectives which include: (1) the skills (or tasks) which the student must learn; (2) the conditions under which the student must perform; and (3) the standard or level of achievement to which the student must perform.

The purpose of the Curriculum Unit (CBVE) is to develop and assist the implementation of competency-based instructional materials. The Unit is located at:

1910 Capital Plaza Tower
Frankfort, KY 40601

To facilitate the implementation of CBVE materials, a person has been identified in each vocational region as a CBVE Contact Person. Please address any problems or concerns about your CBVE program to your Regional Contact Person.

By the time you receive your CBVE materials, you should have attended a workshop for teachers implementing CBVE materials. The Inservice Education modules, which were distributed at the workshop, are your greatest source of suggestions for setting up and managing a CBVE program. For more detailed information, consult your inservice modules or your Regional Contact Person.

Using the Instructor's Manual

This Instructor's Manual is divided into two sections: introductory materials and Instructor's Guide to Learning Activities. The introductory materials include, among other things, the Program Master Sequence. It contains a listing of the task assignment sheet and slide/tape titles, code numbers, and stock numbers.

You can use the Program Master Sequence as a quick reference guide to the contents of the instructional program, as well as a checklist for insuring that all materials have been received. The code numbers and stock numbers serve as a guide to ordering additional materials.

The Instructor's Guide to Learning Activities is the heart of this manual, because it contains a brief listing of the contents of each task assignment sheet with suggestions for its use. It is suggested that you insert the corresponding task assignment sheet behind the Guide Sheets so you will have the complete program in one place.

Format is consistent throughout all CBVE programs in that the materials contain the same basic components:

Introduction - tells the student what he/she will learn and why it is important.

Objective - clearly states what the student is expected to know or do, under what conditions, and how well.

Learning Activities - a "road map" for the student to follow in going through the task assignment sheets; list the various activities the student will perform in learning the task.

Instructor's Final Checklist - tells the student and the instructor exactly what the student will be evaluated on in the check-out activity; the instructor uses this sheet to rate the student's performance.

Check-Out Activities - tells the student what he/she will be asked to do for the final test or performance.

The Instructor's Guide Sheets in this manual present the essential information in capsule form. In addition, they list: the recommended references and audio-visuals; attitudes and values to be developed; notes and suggestions for instruction; alternate activities for students; necessary tools and equipment; and space for teacher's notes.

The task assignment sheets are designed to be left intact. Students should be reminded not to write on any of the pages. In some cases, they will be required to obtain duplicates or sheets like the ones shown. These are often student self-checks. They can be filed in a folder and can be obtained as needed.

The Instructor's Final Checklist is another page that should not be written on. It should remain in the task assignment sheet although you may want to make additional copies of it to place in students' folders.

NARRATION FOR SLIDE-TAPE PRESENTATION PA-TR

"Overview of Transportation"

Slide 1: Overview of Transportation

Slide 2: Transportation: What is its purpose? What job families make up the Transportation Industry? And in what ways is transportation used? You will learn these things about transportation as you go through this slide-tape presentation.

Slide 3: Let's talk first about the purpose of transportation.

Slide 4: The story of transportation began thousands of years ago. People used their feet to get from one place to another, and they carried heavy loads on their backs. This boy is doing this for fun, but years and years ago, this was the only mode of transportation available.

Slide 5: Down through the ages, people experimented with machines and things that would carry them easier and faster.

Slide 6: Today, we have come a long way in our modes of transportation. Look at some of the ways people get from one place to another -- modern cars,

Slide 7: and trucks,

Slide 8: trains,

Slide 9: modern ships,

Slide 10: planes,

Slide 11: and even space ships.

Slide 12: You may not have thought about a pipeline as being a mode of transportation, but any device that moves anything from place to place is considered a means of transportation.

Slide 13: Now, do you know the purpose of transportation? Obviously, its purpose is to move people and products from one place to another.

Slide 14: The Transportation Industry is made up of four job families. Remember, a job family is a group of jobs that are related in some way.

Slide 15: One job family is Land Transportation. This kind of transportation moves people and products over roads,

Slide 16: and also by rail.

Slide 17: The second job family is Water Transportation. It moves people and products by rivers and lakes

Slide 18: and by ocean, as well.

Slide 19: The Aerospace Family carries people and things through the air. It, too, is made up of two kinds of travel -- air travel

Slide 20: and space travel.

Slide 21: The fourth job family is the conveyor family. Conveyors are mechanical equipment used for carrying people and materials from place to place. Some conveyor systems are pipelines,

Slide 22: pulleys,

Slide 23: moving units,

Slide 24: belts, such as escalators,

Slide 25: and roller conveyors.

Slide 26: The four transportation job families, again, are Land, Water, Aerospace and Conveyor.

Slide 27: Transportation certainly plays an important part in the World of Work. Let's sort it out so that you can see how you are really affected by it.

Slide 28: It serves you personally. Your needs, such as food, clothing, and shelter depend on transportation to get them to you. Your wants, such as taking a trip, certainly depend on transportation.

Slide 29: Transportation serves education. Most of the people in your school ride to and from school everyday. Supplies, equipment, and food are brought in. Repair people bring their trucks to the school. Schools would have a hard time operating without transportation.

Slide 30: Transportation serves business and industry. Things that you buy don't just happen to be there. They are transported to the stores where you buy them. They may be moved through several parts of the country before they get to you.

Slide 31: Transportation serves our government. Most of our government agencies could not function without transportation. Think about our mail delivery system. Mail is transported all over the world.

Slide 32: Our military forces depend on many kinds of transportation in order to protect our country.

Slide 33: Our government officials travel to places where they are needed.

Narration (p. 3)

Slide 34: How, then, does transportation fit into the World of Work? It is easy to see that our World of Work depends on transportation to move people and products from one place to another. It touches all of our lives.

Slide 35: This concludes the "Overview of Transportation." Please rewind this tape and leave the slide-tape presentation ready for use again.

INSTRUCTOR'S GUIDE TO LEARNING ACTIVITIES

IDENTIFYING ENERGY SOURCES

OBJECTIVE

GIVEN a list of energy sources and a description of each,

MATCH THE ENERGY SOURCE WITH ITS DESCRIPTION.

YOU should match at least 90% of the energy sources correctly.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will realize that all power systems require an energy source in order to operate.

CONTENTS OF MODULE

Instruction Sheet	Learning Activity Number
I. SOURCES OF ENERGY	1
Instructor's Final Checklist	
IDENTIFYING ENERGY SOURCES	5

CHECK-OUT ACTIVITY

Your teacher will provide a test on sources of energy. Complete the test.

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Have students read about the basic sources of energy. Conduct a discussion: --Definition of energy --Difference between potential and kinetic energy --Descriptions of each energy source Explain how solar energy produces wind, water, heat, and fossil fuel sources.	Instruction Sheet I	
2	Have students list several energy converters; for instance, gasoline engine, electric light, telephone, heating system of a house. Have them bring pictures of or an actual energy converter to class.		
3	Have students report how energy is used in the home, school, industry, transportation, or recreation.		
4	Conduct a discussion on the importance of conserving energy. Have students make posters or a bulletin board display on a way to conserve energy.	Poster and/or bulletin board supplies	
5	Provide each student a copy of the Check-Out Activity Sheet or write	Check-Out Activity Sheet (Master Copy in this section)	

L.A#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
5	the information on the chalkboard. (Students use their own paper; therefore, the test will have to be duplicated only one time and may be filed for future use.) Use the Answer Key to Check the answers. Use the Instructor's Final Checklist to evaluate each student's performance.	Answer Key (Copy follows Check-Out Activity Sheet) Instructor's Final Checklist	

CHECK-OUT ACTIVITY

IDENTIFYING ENERGY SOURCES

Copy each energy source listed below on your paper. Match each energy source with its description by writing the letter of the description after the energy source.

Energy Source	Description
Heat	a. Heat, radiant, and atomic energy source; basic energy source: water, air, plants, heat
Mechanical	
Electrical	
Sound	b. Vibration of molecules
Chemical	
Atomic	c. Fusion or fission of atoms
Solar	
	d. Vibration of particles of matter which are transmitted through the air or solid objects
	e. Energy of motion
	f. Chemical action between molecules
	g. Vibration of electrons

CHECK-OUT ACTIVITY

ANSWERS

Heat - b

Mechanical - e

Electrical - g

Sound - d

Chemical - f

Atomic - c

Solar - a

IDENTIFYING SIMPLE MACHINES

OBJECTIVE

LIST AT LEAST FIVE SIMPLE MACHINES.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will realize that simple machines make it possible to do jobs which primitive people thought were impossible.

CONTENTS OF MODULE

Instructor's Final Checklist	Learning Activity Number
IDENTIFYING SIMPLE MACHINES	7

CHECK-OUT ACTIVITY

List at least five simple machines.

SUGGESTED REFERENCE

Suess, Dugger, patrick, Ziegler, Introduction to Power systems, Glencoe Publishing Co., Inc., 1976.

IDENTIFYING SIMPLE MACHINES

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Have students read about the lever principle. Discuss the three classes of levers.	Introduction to Power Systems, pp. 55-56, 60-62	
2	Have students read about simple machines that operate on the lever principle: --wheel and axles --gears --pulleys Read and discuss one simple machine at a time.	Introduction to Power Systems, pp. 66-74	
3	Prepare a display and let students examine the simple machines.	Simple machines that operate on the lever principle as discussed above	
4	Have students read about inclined planes. Discuss the information.	Introduction to Power Systems, pp. 75-78.	
5	Prepare a display and let students examine the simple machines.	Simple machines that are inclined planes; e.g., --Loading ramp --Wedge --Chisels --Screw	
6	Have students examine a bicycle and list the simple machines used.	Bicycle	
7	Have students list at least five simple machines. Use the Instructor's Final Checklist to evaluate each student.	Instructor's Final Checklist	

DEMONSTRATING USE OF SIMPLE MACHINES

OBJECTIVE

GIVEN a simple machine used in transportation,

DEMONSTRATE ITS USE.

YOU should demonstrate how the machine works and explain what change it causes.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will understand that simple machines have been modified to improve their efficiency.

CONTENTS OF MODULE

Instructor's Final Checklist	Learning Activity Number
DEMONSTRATING USE OF SIMPLE MACHINES	3

CHECK-OUT ACTIVITY

Demonstrate the use of the simple machine you selected in Learning Activity 2. Explain whether it causes a change in force, direction or distance.

SUGGESTED REFERENCE

Suess, Dugger, Patrick, Ziegler, Introduction to Power Systems, Glencoe Publishing Co., Inc., 1976.

DEMONSTRATING USE OF SIMPLE MACHINES

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Have students look at illustrations of simple machines in action; AND/OR demonstrate for the class how some of the simple machines are used.	Introduction to Power Systems, pp. 55-88 AND/OR Simple machines	
2	Have students select a simple machine used in transportation; study how it works; and find out whether it causes change in force, direction, or distance. (NOTE: You may have students bring devices from home, such as kitchen appliances. NOTE: You may also consider having students do some of the "Explorations" in Introduction to Power Systems.)	Simple machines	
3	Have each student demonstrate the use of the simple machine. Use the Instructor's Final Checklist to evaluate each student's performance.	Simple machines selected in Learning Activity 2 Instructor's Final Checklist.	

IDENTIFY ADVANTAGES AND DISADVANTAGES OF FRICTION

OBJECTIVES

(1) LIST AT LEAST THREE ADVANTAGES AND THREE DISADVANTAGES OF FRICTION.

(2) USING two objects,

DEMONSTRATE A USEFUL OR A HARMFUL EFFECT OF FRICTION.

YOUR performance will be rated in accordance with the Instructor's Final Checklist.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will realize that friction plays a dual role in transportation; it is both useful and harmful.

CONTENTS

	Learning Activity Number
Instructor's Final Checklist	
IDENTIFY ADVANTAGES AND DISADVANTAGES OF FRICTION....	4

CHECK-OUT ACTIVITIES

(1) List at least three advantages and three disadvantages of friction.

(2) Demonstrate a useful or a harmful effect of friction.

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Explain and demonstrate the three causes of friction: a. intermeshing of small irregularities on the surfaces (use pieces of wood). b. adhesion due to molecular attraction between surfaces (use pieces of polished metal; they will stick together). c. idention of hard body into soft body (use piece of rubber and piece of metal). Have students experiment with several types of materials to differentiate the resistance of each.	Two pieces of wood Two pieces of polished metal One piece of rubber and and piece of metal	
2	Demonstrate useful effects of friction in: a. stopping; e.g. press rubber sole of shoe against floor. b. traction; e.g. strike match on rough surface. c. slipping; e.g. sand on slippery surface. Have students list other examples, such as: --treads on tires --rosin on fingers --cleated and rubber soled shoes --ashes and cinders on ice	Rubber-sole shoes Book of matches Cup of sand	

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
3	Demonstrate a harmful effect of friction; e.g. a worn part of a tool. Have students list other examples, such as: --overheating --difficult motion --slow motion --burns or blisters on hands	A tool or machine part worn by friction	
4	Have students list at least three advantages and three disadvantages of friction. Have each student demonstrate a useful OR a harmful effect of friction. Use the Instructor's Final Checklist to evaluate each student's performance.	Two small objects for each student Instructor's Final Checklist	

USE LUBRICANTS TO OVERCOME FRICTION

OBJECTIVE

GIVEN two objects,

USE A LUBRICANT TO OVERCOME FRICTION.

YOUR lubricated objects should be smooth and slippery and move easily.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will realize the importance of keeping the moving parts of their machinery well lubricated.

CONTENTS OF MODULE

Instructor's Final Checklist	Learning Activity Number
USE LUBRICANTS TO OVERCOME FRICTION	4

CHECK-OUT ACTIVITY

Move together the two objects you chose in Learning Activity 3 to demonstrate the amount of friction present. Then apply the lubricant and move the objects together again.

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Make a display of lubricants. Let students examine them.	Lubricants such as graphite, wax, grease, oil, silicone	
2	Lubricate the two objects, and explain how the lubrication helps overcome friction: the two surfaces ride on the lubricant and do not touch each other. Let students practice lubricating objects. Suggested activities: a. Hold blade tip of screwdriver between fingers. Lubricate blade, and attempt to hold it between fingers. b. Place wood block at 45° angle. Attach another wood block to small scale, such as fish scale. Pull block up incline and weigh pounds of pressure. Lubricate the blocks. Pull block up incline and measure pounds of pressure again. c. On an inclined plane, place two toy cars. Oil wheels of only one car. Let both cars run down hill, and see which one runs the fastest and the fartherest.	Two objects Lubricant	
3	Have students choose a lubricant and two objects for use in the Check-Out Activity.		

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
4	Have each student move together his/her two objects, to demonstrate the amount of friction present, apply lubricant, and move objects together again. Use the Instructor's Final Checklist to evaluate each student's work.	Two objects and a lubricant chosen in Learning Activity 3. Instructor's Final Checklist	

IDENTIFYING BASIC SYSTEMS OF A FOUR-CYCLE ENGINE

OBJECTIVE

GIVEN a small four-cycle engine,

REPORT ON ONE OF THE SYSTEMS.

YOUR REPORT should identify the system and explain the function of each part correctly.

ATTITUDES AND VALUES TO BE DEVELOPED:

--Students will realize the importance of safety practices when working with any kind of engine.

CONTENTS

	Learning Activity Number
Instructor's Final Checklist	
IDENTIFYING BASIC SYSTEMS OF A FOUR-CYCLE ENGINE	8

CHECK-OUT ACTIVITY

Make a report on the system you chose in Learning Activity 7. Identify the system and explain the function of each part.

SUGGESTED REFERENCES

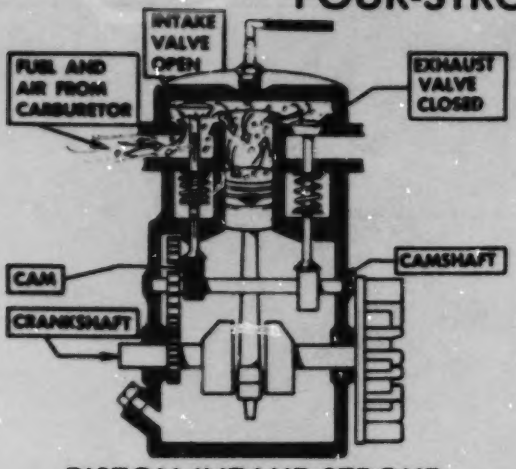
AAVIM, Small Engine, Vol. 2. Available from Kentucky Department of Education, Office of Research and Planning, Capital Plaza Tower, Frankfort, KY 40601. $5.00.

Miller, Maddox, and Smith, Exploring Careers in Industry, McKnight Publishing Co., 1975.

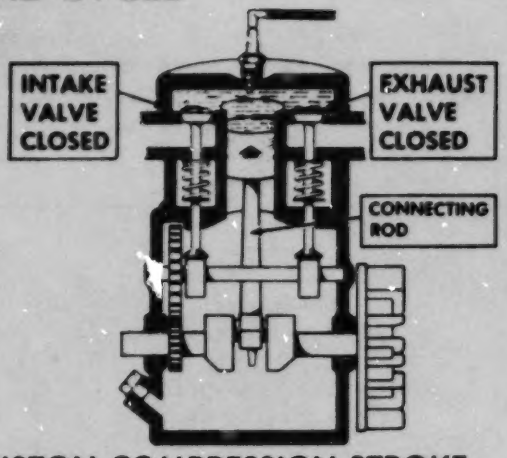
LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Explain to the class the four strokes required to run a four-cycle engine: --Intake --Compression --Power --Exhaust	"Four-Stroke Cycle" (In this section)	
2	Show the class the parts of an ignition system. You may use an actual engine or an illustration. You may have the class read about or you may explain the function of the system and how it works. Conduct a question-and-answer session at the end of the lecture.	Small Engines, Vol. 2, pp. 45-46 Exploring Careers in Industry, pp. 327-328	
3	Show the class the parts of a cooling system. (Follow procedures in Learning Activity 2.)	Small Engines, Vol. 2, pp. 98-100 Exploring Careers in Industry, pp. 329-330	
4	Show the class the parts of a lubricating system. (Follow procedures in Learning Activity 2.)	Small Engines, Vol. 2, pp. 162-163 Exploring Careers in Industry, pp. 328-329	
5	Show the class the parts of a fuel system. (Follow procedures in Learning Activity 2.)	Small Engines, Vol. 2, pp. 78-80 Exploring Careers in Industry, pp. 321-323	
6	Show the class the parts of an exhaust system. (Follow procedures in Learning Activity 2.)	Small Engines, Vol. 2, pp. 110-111	

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
7	Have students make a thorough study of one of the systems. They must be able to identify each part and explain its function.	Small engine	
8	Have students report orally or in writing on the basic system selected in Learning Activity 7. Use the Instructor's Final Checklist to evaluate each report.	Small engine Instructor's Final Checklist	

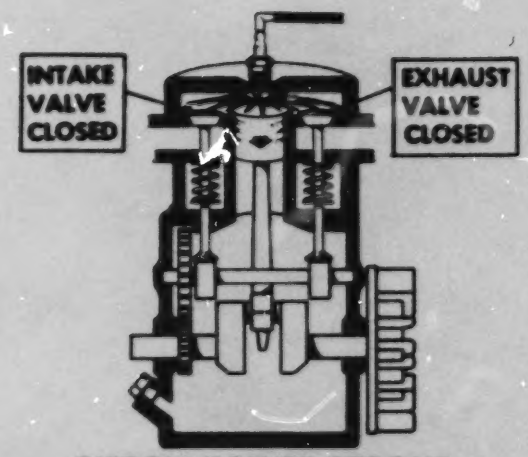
FOUR-STROKE CYCLE



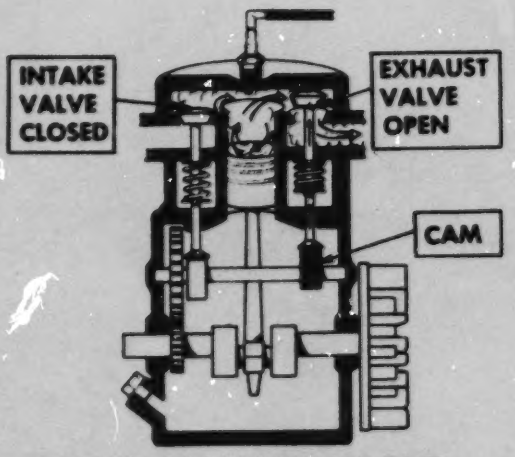
PISTON INTAKE STROKE



PISTON COMPRESSION STROKE



PISTON POWER STROKE



PISTON EXHAUST STROKE

Taken by permission by "Comprehensive Small Engine Repair," Mid-America Vocational Curriculum Consortium, Inc., Stillwater, OK, 1977.

IDENTIFYING TOOLS USED IN MAINTAINING ENGINES

OBJECTIVE

GIVEN a display of tools used to work on a small engine,

IDENTIFY EACH TOOL.

YOU SHOULD identify at least 90% of the tools correctly.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will realize that engines must be kept in good condition if they are to perform at maximum efficiency.

CONTENTS

	Learning Activity Number
Instructor's Final Checklist	
IDENTIFYING TOOLS USED IN MAINTAINING ENGINES	3

CHECK-OUT ACTIVITY

Your teacher will provide a display of tools used to work on small engines. Name the tools.

SUGGESTED REFERENCE

Stockel, Auto Mechanics Fundamentals, Goodheart-Wilcox Co., Inc., 1978.

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Display the tools used in maintaining engines. (If you do not have the actual tools available, you may let the students look at pictures of the appropriate tools in the reference book.) Describe the tools, giving the names and function. Describe special features, such as various sizes, etc. Emphasize safety rules. Let students examine the tools to look at special features and to see how they work.	"Tools Used in Maintaining Engines" (Master Copy in this section) Auto Mechanics Fundamentals, pp. 423-442	
2	Divide the class into five groups. Have each group make a display of actual tools or make a poster with pictures showing tools used for one of the following operations: --Disassemble an engine. --Measure and evaluate the parts and conditions of an engine. --Reassemble an engine. --Test run an engine. --Make external adjustments on an engine. A tool list for each operation is in this section of the manual.	Tools or pictures of tools in tool catalogs "Tools Used for Maintenance Operations" (Master Copy in this section) Display area Poster supplies	

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
3	Prepare a display of tools used to work on small engines. Have the students name them either orally or in writing. Use the Instructor's Final Checklist to evaluate each student.	Display of tools (actual tools or pictures) Instructor's Final Checklist	

TOOLS USED IN MAINTAINING ENGINES

SAFETY DEVICES:

Carbon dioxide fire extinguisher
Fireproof rag container
Fire blanket

FUNNELS:

1 medium
1 small

GAUGES:

1 set of 3 telescopic gauges
Feeler gauge, blade type .001" to .025"
Wire gauge for spark plugs

MALLETS:

10-oz. rawhide
24-oz. brass

MICROMETERS:

0-1"
2"-3"

PLIERS:

Needle nose
Snap ring
6" combination
8" combination

SCREWDRIVERS:

Standard (assorted)
Phillips (assorted)

SOCKETS:

Set 3/8" drive, 3/8" to 15/16"

WRENCHES:

Set ¼" to 1" combination
Set ¼" to 1" open end
12" pipe
12" adjustable

SPECIAL TOOLS:

Compression tester
Divided parts pan (ice cube tray)
Flywheel holder
Gasoline can
Machinist vise
Nut driver set
Oil can spout
Pump oil can
Set gear pullers
Drill
Set 1/16" to ½" by 64th straight shank drill bits
Engine stand

TOOLS USED FOR MAINTENANCE OPERATIONS

OPERATION: DISASSEMBLE AN ENGINE

Safety devices

Carbon dioxide fire extinguisher
Fireproof rag container

Mallets

10-oz. rawhide
24-oz. brass

Pliers

Needle nose
Snap ring
6" combination
8" combination

Screwdrivers

Standard (assorted
Phillips (assorted)

Sockets

Set 3/8" drive, 3/8" to 5/16"

Vise

Machinist

Wrenches

12" pipe
Set ¼" to 1" combination
Set ¼" to 1" open end

Special Tools

Compression tester
Divided parts pan
Flywheel holder
Nut driver set
Set gear pullers

OPERATION: MEASURE AND EVALUATE THE PARTS AND CONDITIONS OF AN ENGINE

Safety devices

Carbon dioxide fire extinguisher
Fireproof rag container

Gauges

1 set of 3 telescopic gauges
Feeler gauge, blade type .001" to .025"
Wire gauge

Micrometers

0-1"
2"-3"

Vise

Machinist

OPERATION: REASSEMBLE AN ENGINE

Safety devices

Carbon dioxide fire extinguisher
Fireproof rag container

Guages

Feeler guage, blade type .001" to .025"
Wire guage for spark plugs

Screwdrivers

Standard (assorted)
Phillips (assorted)

Sockets

Set 3/8" drive, 3/8" to 15/16"

Mallets

10-oz. rawhide
24-oz. brass

Pliers:

Needle nose
Snap ring
6" combination
8" combination

Wrenches

Set ¼" to 1" combination
Set ¼" to 1" open end
12" pipe
12" adjustable

Special tools

Divided parts pan
Flywheel holder
Machinist vise
Nut driver set
Pump oil can
Set 1/16" to ¼" by 64th straight shank drill bits

OPERATION: TEST RUN AN ENGINE

Safety devices

Carbon dioxide fire extinguisher
Fireproof rag container
Fire blanket

Funnels

Medium
Small

Pliers

Needle nose

Screwdrivers

4" plastic handle, standard blade

Sockets

Set 3/8" drive, 3/8" to 15/16"

Wrenches

Set ¼" to 1" combination
Set ¼" to 1" open end

Special Tools

Engine stand
Gasoline can
Pump oil can
Oil can spout

OPERATION: MAKE EXTERNAL ADJUSTMENTS ON AN ENGINE

Safety devices

Carbon dioxide fire extinguisher
Fire blanket
Fireproof rag container

Pliers

Needle nose

Sockets

Set 3/8" drive, 3/8" to 15/16"

Funnels

Medium
Small

Gauges

Feeler gauge, blade type .001" to .025"
Wire gauge for spark plugs

Screwdrivers

4" plastic handle, standard blade

Wrenches

Set ¼" to 1" combination
Set ¼" to 1" open end

Special Tools

Engine stand
Nut driver

DISASSEMBLING A TWO- OR FOUR-CYCLE ENGINE

OBJECTIVE

GIVEN a small engine, the service manual, and the appropriate mallets, pliers, screwdrivers, sockets, wrenches, vise, and special tools,

DISASSEMBLE THE ENGINE.

YOU SHOULD follow each step outlined in the manual.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will realize that both time and money can be saved by doing certain maintenance and repair jobs.

CONTENTS

Instructor's Final Checklist	Learning Activity Number
DISASSEMBLING A TWO- OR FOUR-CYCLE ENGINE	6

CHECK-OUT ACTIVITY

You will be provided a small engine and the necessary tools. Disassemble the engine.

SUGGESTED REFERENCES

Engine Service Manual

Crouse. Small Engines: Operation and Maintenance, McGraw-Hill Book Company, 1974.

Miller, Maddox, Smith, Exploring Careers in Industry, McKnight Publishing Co., 1975.

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Go over the major parts of the engine with the class. You may have students point out certain parts as you name them.	Small engine	
2	Display the tools used to disassemble the engine.	10-oz. rawhide mallet 24-oz. brass mallet Needle nose pliers Snap ring pliers 6" combination pliers Standard screwdrivers (assorted) Phillips screwdrivers (assorted) Set sockets, 3/8 "drive, 3/8" to 15/16" Machinist vise Set 1/4" to 1" combination wrenches Set 1/4" to 1" open end wrenches 12" pipe wrench Compression tester Nut driver set Flywheel holder Set gear pullers Wash tank Divided parts pan (ice cube tray)	
3	Have students read and look at pictures about disassembling a small engine. Discuss each step in the process.	Service manual and/or Small Engines: Operation and Maintenance, pp. 324-328 Exploring Careers in Industry, pp. 330-338	
4	Demonstrate how to disassemble the engine. For each part being disassembled, describe which tools are used and how they are used safely.	Small engine Tools listed in Learning Activity 2	

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
5	Let the students practice disassembling the engine. (You may want them to work in groups or individually.)	See Learning Activity 4 Service manual	
6	Have students disassemble the engine. They may work in groups or individually. Use the Instructor's Final Checklist to evaluate the student's work.	Small engine Tools listed under Learning Activity 2 Service Manual Instructor's Final Checklist	

MEASURE AND EVALUATE PARTS AND THE CONDITION OF A SMALL ENGINE

OBJECTIVES

GIVEN a disassembled engine, machinist vise, micrometers, and gauges,

MEASURE AND EVALUATE THE PARTS AND CONDITION OF THE ENGINE.

YOUR WORK will be rated in accordance with the Instructor's Final Checklist.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will realize the importance of being able to accurately evaluate parts and the condition of an engine before it can be satisfactorily repaired.

CONTENTS

Instructor's Final Checklist	Learning Activity Number
MEASURE AND EVALUATE PARTS AND THE CONDITION OF A SMALL ENGINE	4

CHECK-OUT ACTIVITY

Your teacher will provide the necessary tools. Measure and evaluate the parts and condition of the disassembled engine.

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Display the tools to be used to measure and evaluate the parts of the engine. Show the students each of the tools and point out special features.	Machinist vise 0-1" micrometer 2"-3" micrometer 1 set of 3 telescopic gauges Feeler gauge Wire gauge for spark plugs	
2	Show the students the parts of the engine to be measured and evaluated.	Crankshaft journals Engine cylinder bore Piston skirt Air filter(s) Spark plug Points	
3	Demonstrate how to measure and evaluate one part at a time. After each demonstration, let the students practice the process. You may want them to work in groups. Observe their work and make any necessary suggestions.	Tools and parts listed in Learning Activities 1 and 2 Work cart Wash tank	
4	Have students measure and evaluate the parts indicated in the Instructor's Final Checklist. Use the Instructor's Final Checklist to evaluate each student's work.	Tools listed in Learning Activity 1 Parts listed in Learning Activity 2 Work cart Wash tank Instructor's Final Checklist	

REASSEMBLING A TWO- OR FOUR-CYCLE ENGINE

OBJECTIVE

GIVEN a disassembled two- or four-cycle engine and the necessary tools and equipment,

REASSEMBLE THE ENGINE.

THE REASSEMBLED ENGINE, will be rated in accordance with the Instructor's Final Checklist.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will learn that an engine must be assembled in the correct sequence to avoid repeating steps and unnecessary work.

CONTENTS

Instructor's Final Checklist	Learning Activity Number
REASSEMBLING A TWO- OR FOUR-CYCLE ENGINE	5

CHECK-OUT ACTIVITY

Your teacher will provide the necessary tools and equipment. Reassemble the engine.

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
1	Display the tools used to reassemble a small engine, and have the students look them over. They should be familiar with most of them.	Feeler gauge Wire gauge for spark plugs 10-oz. rawhide mallet 24-oz. brass mallet Needle nose pliers Snap ring pliers 6" combination pliers 8" combination pliers Standard screwdrivers (assorted) Phillips screwdrivers (assorted) Set sockets, 3/8" drive, 3/8" to 15/16" Set 1/4" to 1" combination wrenches Set 1/4" to 1" open end wrenches 12" pipe wrench 12" adjustable wrench Nut driver set Flywheel holder Set gear pullers Pump oil can Divided parts pan (ice cube tray) Machinist vise	
2	Go over the parts of the engine that will be reassembled.	Disassembled engine	
3	Demonstrate how to reassemble the engine.	Disassembled engine Tools listed in Learning Activity 1 Safety equipment: --Carbon dioxide fire extinguisher --Fireproof rag container --Fire blanket Wash tank Work cart	
4	Let the students work in groups as they practice reassembling the engine.	Tools and equipment listed in Learning Activity 3	

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
4	Check each group's work to see that it is being done carefully. (NOTE: You may want each group to disassemble the engine for use by another group.)		
5	For the Check-Out Activity, have students work in groups or individually to reassemble the engine. Use the Instructor's Final Checklist to evaluate the student's work.	Tools and equipment listed in Learning Activity 3 Instructor's Final Checklist	

TEST RUNNING A TWO- OR FOUR-CYCLE ENGINE

OBJECTIVES

GIVEN a reassembled two- or four-cycle engine in a well ventilated shop area, the necessary tools and equipment, and a troubleshooting guide,

TEST RUN THE ENGINE.

YOUR WORK will be rated in accordance with the Instructor's Final Checklist.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will be aware of the fact that the life of an engine often depends on the way it is started, operated, and stopped.

CONTENTS

Instructor's Final Checklist	Learning Activity Number
TEST RUNNING A TWO- OR FOUR-CYCLE ENGINE	7

CHECK-OUT ACTIVITY

Your teacher will provide the necessary tools and equipment and a troubleshooting guide. Test run the engine in the shop area.

RECOMMENDED REFERENCE

AAVIM, Small Engines, Volume 1, available through the Department of Education, Office of Research and Planning, Materials and Curriculum Division, Capital Plaza Tower, Frankfort, KY 40601, $4.00. (Teacher Guide, $1.00.)

Operator's Manual

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
	NOTE: This task must be performed in a well ventilated area, either in an approved shop area or in an outside area. Fire safety rules prohibit this operation in a conventional classroom. It is suggested that you have the tools listed at the right available.	Suggested Tools and Equipment: Carbon dioxide fire extinguisher Fireproof rag container Fire blanket Funnel Needle nose pliers Standard blade screwdriver Set 3/8" drive, 3/8" to 15/16" sockets Set 1/4" to 1" combination wrenches Set 1/4" to 1" open end wrenches Gasoline can filled 1-qt. pump oil can filled Oil can spout	
1	Have the class read about starting an engine. Discuss each point presented.	Small Engines, Vol. 1, pp. 124-134. and/or Operator's manual	
2	Demonstrate how to start an engine. Let the students practice the procedure at school or at home.	Small engine	
3	Have the class read about operating an engine. Discuss each point presented.	Small Engines, Vol. 1, pp. 135-138 and/or Operator's Manual	

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
4	Make a troubleshooting guide available to the class. One copy for each five students is preferable. Explain how the guide is used. Have students become familiar with its format.	Small Engines, Vol. 1, pp. 3-4 or Any troubleshooting guide for small engines	
5	Have students read about stopping an engine. Discuss each step presented.	Small Engines, Vol. 1, pp. 138-139 and/or Operator's Manual	
6	Have students practice operating the engine and using the troubleshooting guide to identify the problem. (NOTE: Students will make the necessary adjustments in the following task assignment sheet. They are only to identify the problem here.)	Small engine with a problem that is listed in the troubleshooting guide	
7	Have students test run the engine and identify any engine problems. You may let them work in small groups or individually. Use the Instructor's Final Checklist to evaluate the student's performance.	Small engine with a minor problem that is listed in the troubleshooting guide Troubleshooting guide Necessary tools and equipment Safety equipment Instructor's Final Checklist	

MAKING EXTERNAL ADJUSTMENTS ON A SMALL ENGINE

OBJECTIVE

GIVEN a small engine with external problems, procedures for making the adjustments, and the necessary tools and safety equipment,

MAKE THE ADJUSTMENTS.

THE ADJUSTED ENGINE should start easily and run smoothly and efficiently.

ATTITUDES AND VALUES TO BE DEVELOPED

--Students will learn to detect engine problems that can be corrected by making external adjustments.

CONTENTS

	Learning Activity Number
Instructor's Final Checklist	
MAKING EXTERNAL ADJUSTMENTS ON A SMALL ENGINE	3

CHECK-OUT ACTIVITY

You will be provided the engine and necessary tools and equipment.

Make the external adjustments you identified in Learning Activity I. You may refer to the procedures for making the adjustments.

SUGGESTED REFERENCES

AAVIM, Small Engines, Volume I, available through the Department of Education, Office of Research and Planning, Materials and Curriculum Division, Capital Plaza Tower, Frankfort, KY 40601, $4.00. (Teacher's Guide $1.00)

Operator's Manual

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
	NOTE: This task must be performed either in an approved shop area or outside. Tools needed will depend on the adjustments made.	Suggested Tools and Equipment: Carbon dioxide fire extinguisher Fire blanket Fireproof rag container Needle nose pliers Set 3/8" drive, 3/8" to 15/16" sockets Funnel 1-qt. oil gauge Feeler gauge Wire gauge for spark plugs Standard blade screwdriver Set ¼" to 1" combination wrenches Set ¼" to 1" open end wrenches Engine stand Nut driver 1-qt. oil can filled Oil can spout	
1	Prepare the engine so that is needs one or more adjustments. Suggested Adjustments: Carburetor Choke Throttle Linkage Have students identify the problems.	Small engine which needs adjustment(s) Troubleshooter's guide used in Task Assignment Sheet PA-TR-12	

LA#	NOTES AND SUGGESTIONS FOR INSTRUCTION	REFERENCES AND SPECIAL TOOLS AND EQUIPMENT	TEACHER'S NOTES
2	Have the students look up the procedures for making the necessary adjustments. They must be able to identify the part(s) to be adjusted and the tools necessary to make the adjustments.	Small Engines, Vol. I, (Refer to pp. 124-138) and/or Operator's Manual	
3	Have the students make the necessary adjustments on the engine. They may work in small groups or individually. When the adjustments have been made, have the students start the engine to determine if it runs smoothly and efficiently. Use the Instructor's Final Checklist to evaluate each student's work.	Small engine with same problems as in Learning Activity I Procedures for making adjustments (reference identified in Learning Activity 2) Tools necessary to make adjustments Safety equipment Instructor's Final Checklist	

APPENDIX

VOCABULARY LISTING

Atom - a tiny particle of anything.

Conserve - to keep from loss or from being used up.

Convert - to change.

Electron - negatively charged particles that form a part of all atoms.

Energy - ability for doing work.

Engine System - a set of parts that forms one of the essential operations of the engine

Four-Cycle - an engine that requires four basic operations in order to run.

Horsepower - a unit for measuring the power of an engine. One horsepower equals 550-foot-pounds per second. A foot-pound equals the work of raising one pound one foot.

Kinetic Energy - energy in motion.

Lubricant - a substance used for putting on parts of machines, that slide or move against one another, to make them smooth and slippery so that they will work easily.

Mechanical Advantage - the cause of a change in force, direction, or distance.

Molecule - the smallest particle into which a substance can be divided without chemical changes.

Potential Energy - stored up energy.

Simple Machine - a device that has a mechanical advantage.

PRACTICAL ARTS VIDEOTAPES

These videotapes are available through the Kentucky Department of Education, Office of Research and Planning, Division of Materials and Curriculum, 19th Floor, Capital Plaza Tower, Frankfort, Kentucky 40601; Telephone: (502) 564-2000.

Agribusiness, Natural Resources and Environmental Occupations

"Coal: Kentucky's Ace in the Hole": 1/2-inch color cartridge; 23 minutes; some on 1/2-inch reel-to-reel; 2 copies on 3/4-inch cassette. Describes types of occupations available in the coal industry and discusses useful coal by-products.

"Wildlife": 3/4-inch color cassette; 25 minutes. Explains the role of wildlife in conservation.

"Energy Careers": 1/2-inch color cartridge; 15 minutes; some on 1/2-inch reel-to-reel; 2 copies on 3/4-inch cassette. Explores careers in the alternative energy areas of solar energy, wind, and coal liquification.

"Agribusiness": 3/4-inch color cassette; 18 minutes. Deals with careers in agriculture and other farm-related careers.

Business and Office Occupations

"The Secretary": 3/4-inch cassette; 18 minutes. Identifies various careers available in the secretarial field.

Communications and Media Occupations

"One Moment, Please": 1/2-inch color cartridge (2 cartridges available); 18 minutes. Explores occupations, ranging from camera operator to producer, available in radio and television production and necessary qualifications.

"Number, Please": 3/4-inch color cassette; 18 minutes. Discusses careers available in the telephone industry and shows on-the-job interviews for jobs in the industry.

"Roll the Presses": 3/4-inch cassette; 19 minutes, 20 seconds. Gives overview of careers needed to produce a newspaper.

Construction Occupations

"Construction Careers": 1/2-inch color cartridge; 20 minutes; some on 1/2-inch reel-to-reel; 2 copies on 3/4-inch cassette. Explores types of occupations, including carpenters, electricians, and plumbers, in construction careers and necessary skills needed for these careers.

Home Economics Occupations

"Gainful Home Economics": 3/4-inch color cassette; 20 minutes, 45 seconds. Describes occupations related to home economics in which people are gainfully employed.

Health Occupations

"RX Good Health": 1/2-inch color cartridge; 23 minutes; 2 copies on 3/4-inch color cassette. Explores health careers, such as medical secretary, laboratory technician, and physical therapist, in addition to doctor and nurse.

Hospitality and Recreation Occupations

"Hospitality Unlimited": 1/2-inch cartridge tape; 16 minutes; color; also on 1/2-inch reel-to-reel; 2 copies on 3/4-inch cassette. Indentifies careers in the restaurant industry and hotel/motel management.

Manufacturing Occupations

"Down the Assembly Line": 3/4-inch cassette; 18 minutes. Depicts production line workers on the job; introduces students to the division of labor system whereby each worker becomes skilled in a single operation.

Orientation to the World of Work

"The Rest of Your Life": 2/4-inch cassette; 30 minutes. Introduces students to step-by-step procedures necessary in seeking employment.

Personal Service Occupations

"Barbering and Cosmetology": 3/4-inch cassette. Explores careers available in these two areas.

Public Service Occupations

"Dear John Mail": 1/2-inch color cartridge; 20 minutes; 2 copies on 3/4-inch color cassette. Explores the types of postal careers and available postal facilities.

"Law Enforcement": 3/4-inch color cassette; 25 minutes. Presents occupations available in law enforcement careers, ranging from policeman to radio operator, and their functions; also identifies necessary qualifications for entering the occupations.

"The Military": 3/4-inch cassette; 17 minutes, 30 seconds. Gives students an overview of various careers associated with the military.

Transportation Occupations

"Tracking A Trucker": 1/2-inch cartridge tape; 22 minutes; color; some on 1/2-inch reel-to-reel; 2 copies on 3/4-inch cassette. Explores occupations needed to support the trucking industry from mechanic to driver.

"The People of the Airlines": 3/4-inch cassette; 22 minutes. Shows people on the job at the airport and on the airplane.

REFERENCES APPROPRIATE FOR CAREER EXPLORATION

Documents

Exploring Careers, 1979
Bulletin 2001
Bureau of Labor Statistics
1371 Peachtree Street, N.E.
Atlanta, GA 30309
Telephone: (404) 881-4418

Occupational Outlook Handbook
Bulletin 1955
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
(Cloth Cover) Stock No. 029-001-02067-8
(Paper Cover) Stock No. 029-001-02059-7

Dictionary of Occupational Titles
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
Stock No. 029-013-00079-9

Sources of Information

Practical Arts Unit
Bureau of Vocational Education
21st Floor
Capital Plaza Tower
Frankfort, KY 40601
Telephone: (502) 564-3472

Gregg/McGraw-Hill
Webster Division
1221 Avenue of the Americas
New York, NY 10020

McKnight Publishing Company
Bloomington, IL 61701

New Jersey Vocational Technical
Curriculum Laboratory
Rutgers University
4103 Kilmer Campus
New Brunswick, NJ 08903

Ohio Department of Education
Division of Vocational Education
Career Development Service
Columbus, OH 43215

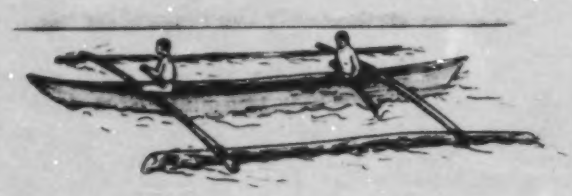
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

Xerox Educational Publications
P.O. Box 16629
Columbus, OH 43216

TRANSPORTATION IN THE NEW WORLD

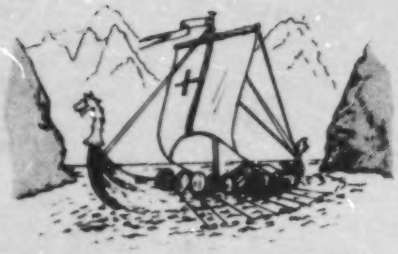
Before white people came to America, Indians lived here. The Indians were wandering people. They were hunters who followed their herds of animals from place to place. At first their feet were their only means of transportation.

The time came when they needed to travel on water, too. So they made a boat out of a hollowed out log. It was balanced by other logs.

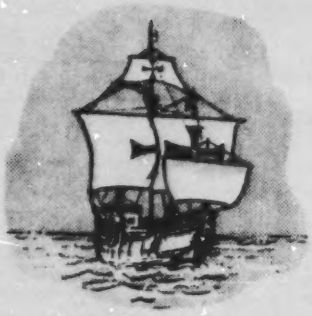


Later they carved out a boat shaped like a canoe. It was lighter and faster.

Around the year 1000, Lief Ericson is thought to have landed on the coast of North America. He was a great seafarer. He sailed in a Viking ship. This ship was pushed through the water by wind. Sailors also helped push the ship with the use of oars. Viking ships are best remembered for the dragon heads carved on the front.



In the 1400's, explorers from Europe began to sail west. Columbus was one of these explorers. He and his crew set sail in three sailboats. As you know, he discovered America in 1492. He went back to Spain to tell the people about the New World. Some of them became so excited, they wanted to explore the land for themselves.



They brought horses with them on the ship. The spanish were the first people to bring horses to the New World.

TRANSPORTATION IN COLONIAL DAYS

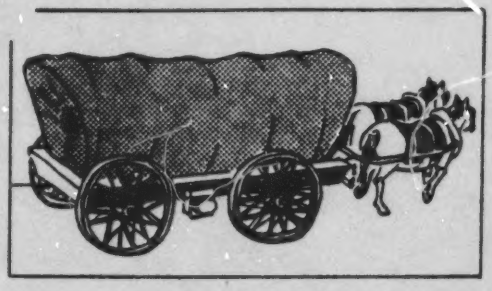
For the next hundred years explorers landed in America. Finally, in the 1600's, groups of people arrived to settle down and stay. They formed colonies. People in the colonies worked hard. They believed if you worked hard you would be rewarded. They were content to stay home, grow their own food, and make the things the people needed. They depended very little on outsiders to bring them provisions. Because of this, they had little need for new kinds of transportation.

As time went on, some of the people were not content to stay home. They wanted adventure. They wanted to open the wilderness for travel. You have heard of men such as Daniel Boone, Johnney Appleseed, and Davy Crockett. These men "blazed a trail" through the mountains and valleys of America. Any time they cleared the land, it was done by hand with crude tools.

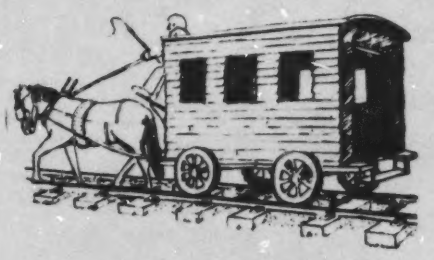
TRANSPORTATION DURING THE WESTWARD MOVEMENT

Old America began breaking up and moving westward in the 1800's. Governments lacked money and tools to build roads. The people made their own roads. Often they were paths made by horses. Other times they were ruts made by wagon wheels.

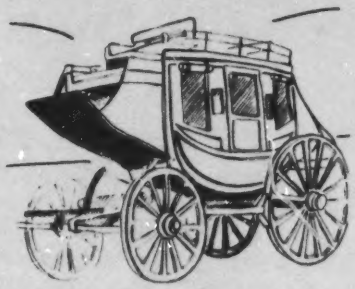
Families that were westward bound moved in covered wagons. These were small wagons so light you could almost carry one. Yet they were strong enough to carry provisions. They were covered, oftentimes by a blanket.



Life was hard in the West. The people found that they had to depend on outsiders to bring them many things they needed. Seeds for their crops, tools, food, and clothing had to be brought to them in many cases. To meet these needs, short railroads were built between towns. At first the trains were pulled by horses.



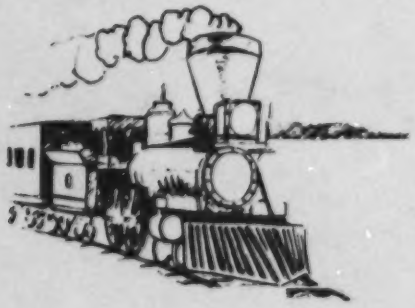
When people in the west traveled longer distances, they went by stagecoach.

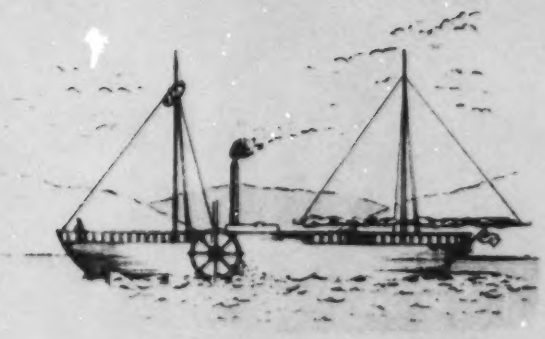


TRANSPORTATION CHANGED AS THE TIMES CHANGED

During the 1800's, people began to travel more. They needed more and better tools. They made more things. They raised bigger and better crops. They wanted more things to make life enjoyable. It was necessary for transportation to change in order to meet those needs. If it had not, problems would have occured.

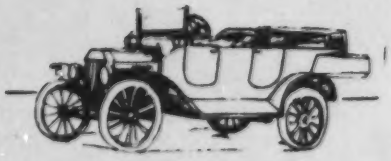
American scientists became interested in the people and wanted to help them. They worked for a long time on a new kind of engine. It ran by steam. This was quiet an improvement over hands, wind, and horses. The steam engines were used mostly in trains



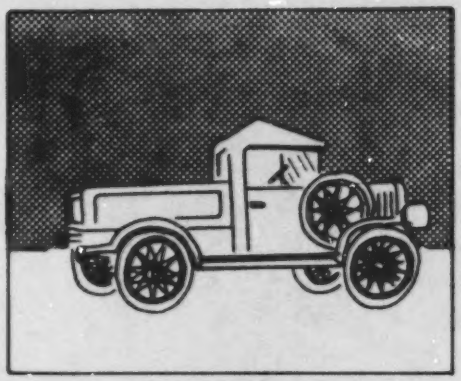


and in boats. These engines made it possible for America to carry on trade with other countries.

Another man brought about an important change in transportation. His name was Henry Ford. He made a car with a gasoline engine. This was quite a change from the steam engine. In 1908, he made his first Model T Ford. Five years later, he was manufacturing it a new way. It was being made on an assembly line.

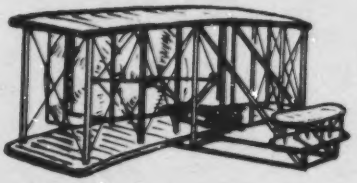


Transportation on Parade (p. 5)



About the same time the Model T Ford was being made, another exciting event took place. Orville and Wilbur Wright built an airplane that would actually fly. This event changed our whole history of transportation. It brought the entire world closer together.

This new way of manufacturing caught on fast. It caused factories to spring up all over the country. Parts and products had to be shipped all over the country. They had to be sent fast at a low cost. This meant transportation had to change to meet the demands. Trucks began to carry the parts and products from coast to coast.



Play

ON THE MOVE

NARRATOR: We of the transportation industry are going to present a play. The of the play is "On the Move." The cast of characters is: Miss TV, Boat, Flatbed truck, Airplane, Forklift, Train, Conveyor Belt, Trailer Truck, Panel Truck, School Bus, and Car. The scene is a conversation between Miss TV and Transportation.

BOAT: Hello, Miss TV. Did you know that you wouldn't be here without my help?

MISS TV: No! What did you do for me?

BOAT: The workers in the forest cut down trees and cut them in logs. Then they loaded the logs on me, and I took them down river to the sawmill. The sawmill workers cut them in smaller pieces of wood.

MISS TV: I'm so glad you are part of the Water Transportation Family, Boat. You can move things on water.

FLATBED TRUCK: Then I came into the picture. I went to the sawmill, and the workers loaded the wood on my truckbed. I hauled the wood to the factory where you were made. It was used to make your pretty wood cabinet.

MISS TV: Thank you, Truck. So you can move things over land. What job family do you belong to?

FLATBED TRUCK: I belong to the Land Transportation Family.

AIRPLANE: Don't forget me, Miss TV. I carry cargo. Japanese workers made the parts you use to make the pictures. I carried those parts as I flew across the Pacific Ocean. (I belong to the Aerospace Transportation Family, you know.) I landed on the West Coast close to a big warehouse. The parts were stored in the warehouse.

FORKLIFT: Yes, I was there. I picked up those heavy boxes and carried them to the warehouse. They stayed there until Train came to take them to the factory.

MISS TV: We are so fortunate to have you, Forklift. You make life so much easier by carrying heavy loads for short distances. What job family are you in?

FORKLIFT: I belong to the Conveyor Transportation family.

TRAIN: Miss TV, I had a hand in your life, too. I went to the warehouse where your parts were stored. The workers there loaded your parts on several of my cars, and I carried them to the factory. Again Forklift carried the heavy boxes inside.

MISS TV: I appreciate all the work you did for me. I know you move on tracks laid on land. Does this mean that you belong to the Land Transportation Family?

TRAIN: You are right, Miss TV.

CONVEYOR BELT: Then, Miss TV, your parts were placed on me, and I moved them down the assembly line past the workers. They picked up the parts as they passed by and put them together to make a TV. Finally, you became a beautiful TV set.

MISS TV: Thank you, Conveyor Belt, for moving my parts down the assembly line. Since you are a belt, what job family are you in?

CONVEYOR BELT: I belong to the Conveyor Transportation Family.

MISS TV: Well, is this the end of the story?

TRAILER TRUCK: No, I'm afraid not, Miss TV. You couldn't just sit in the factory. The TV makers would lose money on you. I took you to a wholesaler who in turn sold you to a TV dealer here in this city.

MISS TV: And is this how I got here in this classroom?

PANEL TRUCK: Yes, the school principal bought you from the TV dealer.

SCHOOL BUS: Don't forget that I play an important part, too. I bring the students to school. They watch the TV programs.

CAR: I play an important part, too. I bring the teachers to school. School Bus and I belong to the Land Transportation family because we move on land.

PANEL TRUCK: And I bring the people who repair Miss TV.

MISS TV: Wait! Wait! I get the "picture." We depend on all kinds of transportation, and workers in transportation depend on products like me to provide jobs. Business and transportation is a two-way road. Business needs transportation, and transportation needs business.

THE END

ADDRESSING STUDENTS WITH SPECIAL NEEDS

Some students may need special help in achieving competencies. Ideas are presented here for helping identify those students and modifying materials and techniques to help them succeed.

Identifying Students with Special Needs

Generally speaking, those students who cannot succeed in the regular vocational education programs without special help are termed "students with special needs" (Vocational Education Act of 1963 and Amendments). Persons most likely to be identified as students with special needs are the academically and economically disadvantaged and the handicapped--the mentally retarded, deaf and hard of hearing, speech impaired, emotionally disturbed, orthopedically (physically) impaired, health impaired, and learning disabled.

The handicapped are further identified as those (1) with a physical or mental disability that substantially impairs one or more major life activities--walking, seeing, hearing, speaking, working, or learning; (2) who have a record or history of such impairment or condition; and (3) who are regarded as having an impairment (Rehabilitation Act of 1973). Women, minorities, the limited English speaking, and others likely to be underemployed or striving for equal opportunity in employment when meeting the criteria for academic or economic deprivation, are specifically identified in the disadvantaged group to be given special help.

Formulating a Basic Approach to Teaching

Society recognizes the right of every individual to an appropriate education, and the law mandates giving persons with special needs an equal chance. In brief:

1. The Vocational Education Amendments of 1976 give special emphasis to developing and providing programs of vocational education for "those with special educational handicaps" and reserves moneys to do so.

2. The Education for All Handicapped Children Act of 1975 assures that all handicapped children between the ages of three to twenty-one have available to them a free, appropriate public education which relates to their unique needs and is provided in the least restrictive environment.

3. The Rehabilitation Act of 1973 prohibits discrimination on the basis of handicap in any program or activity receiving federal financial assistance and directs employers to take affirmative action in hiring handicapped people.

4. The Education Amendments of 1972 prohibit discrimination on the basis of sex in educational programs receiving or benefiting from federal financial assistance.

5. The Civil Rights Act of 1964 prohibits discrimination in employment on the basis of sex, race, color, religion, or national origin in any program or activity receiving federal financial assistance--including training for employment.

We must, then, provide equal opportunity to learn in our instructional processes.

Basically, an approach to teaching which recognizes individual differences in all students provides the best atmosphere for disadvantaged and handicapped students. This approach allows students to work at different rates; involves large group, small group, and individual instruction; incorporates a variety of instructional materials, media, and teaching techniques; and involves a variety of learning activities--reading, doing, discussing, listening, viewing, experiencing, sharing, cooperating, relating, using the senses, etc. It gives disadvantaged and handicapped students the dignity of exploring, learning, and facing the same experiences and responsibilities as other students, without limiting their possibilities by stereotyped concepts of what they can or cannot do.

It involves being organized, with students completely familiar with the teaching/learning plan. When beginning a CBVE class, for example, explain what learning to attain competencies means, how the students will carry out their work, how to use the modules, where to find materials, how and when tests will be given, how "passing" or achieving competency is determined, and what your role as a teacher is.

It also means teacher direction for those students who are not self-directed learners--those with poor academic backgrounds who thrive on teacher interaction and need immediate feedback, instruction simplified, procedures modified, social development as well as specific job skills, role models, or other special aid. For these students, the learning activities described in the modules may become the teacher's lesson plan and be utilized in large-group and small-group settings before the individual student attempts doing learning activities alone. The teacher-directed class might proceed as follows: teacher introduction to tasks to be performed by module or cluster of modules, explanation of what is to be learned and why, presentation of information in small chunks, demonstrations, student tryout and practice, time for questions and answers, trial test followed by reteaching, and evaluation. The teacher will employ a variety of strategies to address the learning needs and styles of the student.

Using Special Strategies

In order to determine the most appropriate teaching strategies, assess the students for kinds of special help required, and develop a plan for meeting any unique needs. Refer to Mainstreaming Guidebook for Vocational Educators by Dahl, Appleby, and Lipe (Olympus Publishing Company, Salt Lake City, Utah 84105), for modifications and general classroom strategies for meeting the unique needs of the different handicapped populations.

Also, enlist the advice and help of employers, support personnel, and agencies and organizations serving disadvantaged and handicapped populations in your school system and geographic area.

Redirecting Teaching Strategies Usually Used

Many of the strategies usually used with regular students may be redirected or modified and also provide effective learning activities for students with special needs. An explanation of how this many be done follows.

AUDIO-VISUALS (films, filmstrips, slide/tape presentations, videotapes, and ETV and commercial television programs). The combination of sight and sound provides more effective communication than either sight or sound alone. Audio-visuals may be used to supplement or replace other methods of presenting information. The hearing impaired will require captioning, signing, or a printed script written at the appropriate reading level or presenting only essential details. The visually impaired may glean information from the sound source, but additional explanation will need to be provided for any visual display of information which is not explained adequately by the narration. Some audio-visual presentations, particularly 8 mm and 16 mm films, may move too fast for the information to be grasped and need to be evaluated with this in mind.

CONTACT WITH WORK ENVIRONMENT. Handicapping conditions, limited finances, geographic isolation, cultural difference, limited communication skills, and social isolation have caused disadvantaged and handicapped persons to have little contact with the world of work. Familiarity with the work setting in which a particular job takes place, relationships with other workers, business use of the telephone, relationship of one's job to other jobs in the same business are just a few examples of areas where special students may require special exposure by means of field trips, spending a day on the job, viewing films, or having additional training sessions.

Note: For those with physical impairments, field trips, on-site job observations, and work experience opportunities will be limited to "accessible" businesses in the community. Before deciding where to go, determine whether the facilities are accessible.

DEMONSTRATION AND TRYOUT. Demonstration by the teacher, experienced workers, and previously-trained students provide reliable role models for learners. Steps, procedures, precautions, physical manipulation, and techniques are imprinted visually in the order and at the time they should occur in task performance. Immediate tryout of the task following the demonstration or an immediate attempt of each step, technique, or procedure as it is demonstrated provides students direct involvement, permits correction and clarification, and promotes retention. Tryout also identifies areas in performance steps, techniques, tools, and work environment where handicapped students need to have modification in order to perform tasks and meet industry standards.

ELIMINATION OF STEREOTYPING. Disadvantaged and handicapped people face more than the sex role stereotyping myths in their quest for employment. The following are just a few examples: "Deaf people are dumb." "The best job for blind people is tuning pianos." "He'll never be able to do that; he's a cripple." "Mr. _____ was no good; neither is his son." "She can

never do that; her parents didn't go to college." In addition to overcoming the unfounded assumptions of others, disadvantaged and handicapped persons often have equal misconceptions about themselves thinking: "I can never do that." "_____, who is deaf, does assembly line work; that's what I'll do, too." "I'll never be anybody."

Overcoming stereotyping may begin with using sex fair instructional materials and media, exploring interests and abilities, exploring two or three nontraditional jobs, or complimenting accomplishments. It may include planning how to reach an educational goal, providing role models (a person with a like handicap or socioeconomic background who has succeeded), as well as observing persons in nontraditional work roles. It means doing whatever raises aspirations and increases self-worth. It means attempting to eliminate underemployment.

EMPLOYER INVOLVEMENT. Programs with employer input are more practical and in line with the current needs of the job market. Employers who make input feel a special kinship to the program and get a chance to see the students before meeting them in the job market.

For disadvantaged and handicapped students, employer involvement offers a very special opportunity to remove common misconceptions about their capabilities. It enables employers to help with any modification needed, see students performing tasks, and observe how the students relate to others. It gives students a chance to prove that they can do the work, that they will not endanger themselves or others, and that they will not increase expenses. These are major employer concerns. Both students and teachers should be prepared to provide reassuring answers and evidence to show there is no more risk than with the nonhandicapped.

Employers may be involved by giving class presentations; giving suggestions for program improvement and modifications; conducting mock interviews; and providing work experience, observations, worker interviews, job analysis, etc.

HANDS-ON EXPERIENCES, PROBLEM SOLVING, PERSONAL INVOLVEMENT (work samples, tryout exercises, games, role playing). Being involved in a sample of work through completing a product, performing related paper work, or role playing interpersonal relationships on the job keeps students interested, holds attention to the learning tasks, and injects the realities of working and job performance in the teaching/learning situation. It makes the student feel that the instruction is practical and valuable. Accomplishment means "qualified for work"--a great boost to self-esteem for those who doubt self-worth.

The instructor and other students should avoid taking over when handicapped students are awkward or slow in completing a task. The student cannot master the skill if someone else does it.

ILLUSTRATIONS (pictures, graphs, bulletin boards, transparencies, and other visuals). The disadvantaged, the mentally retarded, and the hearing impaired, particularly, are especially oriented to visual methods of learning. Other students, with the exception of the blind and some visually impaired, will appreciate visual presentation of information to

be learned. Student handouts, with the steps to a task illustrated and briefly and simply explained, are especially helpful. Captioning and brief explanations are important supplements. Many illustrations may be adapted for the visually impaired by making them tactile (so that they can be felt). Sometimes enlarged print and bold outlines help.

INTERACTION; INDEPENDENCE. Economic deprivation, geographic isolation, cultural isolation, and restrictions on mobility and social relationships imposed by physical impairments have limited the experiences of the disadvantaged and the handicapped in the community at large. Many have no previous work experience, little observation of the worker's daily routine, and limited social experiences. They have been sheltered at home, absent from the scene, and at best, onlookers.

So that they will not continue in this role after vocational training, experiences in the community and involvement with nonhandicapped people and other students are of utmost importance. These students, as well as their families and the working community, need proof that they can function independently and competently. They need to establish contacts who can serve as references to recommend them as competent workers who can relate to others.

Field trips, worker interviews, cooperative work experience, spending a day on the job, giving talks before civic groups are, therefore, important to the acclimation of disadvantaged and handicapped students to the world of work. Participating in team work projects with other students; pairing with a slower or faster learning peer; pairing with a nonhandicapped, a nondisadvantaged, or person from another race or culture will help achieve faster comprehension and understanding and promote learning communication skills. Teaching special units dealing with related communication and social skills will also be necessary; for example: office etiquette, relationships with employer and other employees, daily work expectations which are not direct task performance, telephone skills, appropriate dress and grooming habits, to name a few.

LISTENING (explaining, discussing, reacting orally). Learning by listening is an important tool to the disadvantaged, the visually impaired, the speech impaired, the learning disabled, and others who "prefer to be told" or "have to be told" rather than read about it.

The visually impaired require identification of familiar sounds in the work place to determine location of different work areas, equipment functions, and hazards. The hearing impaired require sight substitutions, such as indicator lights, for critical sounds they cannot hear. They may use lip reading, interpreting, and sound conduction or amplification devices. The retarded need to become accustomed to the sounds of the work place so that they can work without being distracted. The speech impaired need to be given the right to listen although they may have trouble participating, or may not be able to participate orally.

When information is presented for listening, instruction in how to listen (what to listen for) is important. An outline of the information presented, supplemented by visuals, tryout exercises, showing, completion

of a guidesheet questions to be answered, analysis of cases or problem situations, or other application activities will enhance use and retention of information heard.

Listening is a vocational skill as well as a learning skill. Workers must be able to receive information by listening as well as provide information for listening. Most on-the-job instruction is given orally. Explanation must be given to and received from customers, co-workers, and supervisors.

READING HELPS. Being fluent in the technical vocabulary or language of the job and able to read at the level required by the job is a part of occupational competency. On-the-job reading requirements may vary from the reading of signs to following instructions given in technical manuals. The instruction given in reading, then, for vocational purposes, will depend on the reading skills possessed by the student and the reading requirements of the job. Whether or not a supplemental class in remedial reading is offered, the vocational instructor will find that providing reading aids also helps provide job skill.

Braille materials, large print textbooks, magnifying devices, and recordings may be provided for the visually impaired. Materials may be simplified or outlined for the hearing impaired and others with limited language skills. The native language may be supplied above the English for critical information in textbooks used by the limited English-speaking. Familiarity with the setting in which the printed information is applied may be given via field trips, demonstrations, or films to make reading easier and more meaningful.

Students with exceptional reading problems may require the help of a special reading teacher or be enrolled in a remedial reading program. Some schools employ vocational reading teachers to assist vocational students with developing vocational reading skills and doing the reading required in their programs.

RECORDING AND RECORDINGS (tapes, records, radio programs). Information may be presented and gained by listening to recorded information rather than reading. This strategy will aid the nonreader, the poor reader, the visually impaired, the learning disabled, and others through use as a variation of teaching technique. Recording is also a useful tool for the deaf in notetaking; the recording script may be transcribed into print later by a hearing individual. It will also provide instruction for those who have missed initial classroom presentation of information or who need review. Recordings may be supplemented by slides and pictures.

RELATED MATH. Competency in math, like competency in reading, is more critical to some jobs than to others. Math is best taught in relation to the task of which it is a part. This instruction should incorporate basic math and remedial math instruction as needed. A cooperative or team teaching effort with the math teachers or related math instructors in the school will relieve the burden on the vocational instructor. Enough practice and application exercises should be provided to insure retention of the math operations involved. It is helpful to compile a list of the

math competencies needed to complete the training program, prepare an assessment test to determine student skills, and plan in the beginning a program which the student can follow to attain the basic math competencies prerequisite to the course. If the skills cannot be acquired simultaneously to the job skill training program, the student should postpone entry into the course until the prerequisite skills are attained. It may be necessary to prepare a special manual and modules to provide the related math instruction.

REMEDIAL AND RETENTION EXERCISES. Doing learning activities does not necessarily make students occupationally competent. Performance must be observed, misunderstandings clarified, procedures and techniques corrected, and repetition called for at a future time. Lesson planning should anticipate theory and tasks with which students are likely to have difficulty, include additional practice exercises, and provide alternate approaches to teaching. Repetition for retention should be provided, such as repetition of information in different media presentations or use of different types of application exercises. Review sessions, keeping notebooks, completing work samples, doing live work, and solving cases will also help.

SAFETY. The Occupational Health and Safety Act has increased employer concern for safety and underscored the importance of providing safety instruction along with task performance. It is especially important for the handicapped in two ways: (1) to overcome employer concern about the handicapped person's ability to take care of himself/herself and not endanger the lives of others; (2) to identify and deal with situations which are hazardous for persons because of particular handicaps.

To meet these needs for safety instruction, the handicapped student not only needs the basic or general safety instruction related to the occupation but safety instruction or special safety provisions needed for a person with his/her particular handicap. An example is the installation of a blinking light to tell a person who is deaf that the equipment is running.

Note: The Kentucky Department of Labor, Occupational Safety and Health Program, Division of Education and Training, Frankfort, Kentucky 40601, Phone: (502) 564-6895, offers training programs to help vocational instructors teach safety.

SUPPORT SERVICES. Some students will require emotional, social, and financial support in order to succeed in the instructional programs. Others will need career counseling and special assistance in becoming employed. Government agencies, special schools, special personnel, and organizations for disadvantaged and handicapped persons can provide this help. The following are examples and should not be considered an all-inclusive list: resource room teachers, rehabilitation counselors, guidance counselors, tutors, remedial teachers, instructors in special schools, occupational therapists, diagnostic specialists, media personnel, handicapped workers, workers who are members of a minority group, social workers, and others who can serve as role models. Survey the community to identify persons who serve the needs of disadvantaged and handicapped persons in your area and incorporate their assistance in related learning activities.

UNIQUE MODIFICATIONS (modified equipment, tools, learning aids, changes in work environment, adaptations in course or training program content). Some students require special help in meeting physical job requirements. When considering modification, it is important to concentrate on what the student can do. If at all possible, enable the student to function in the work environment as it is usually found. Employers look favorably on handicapped persons with this kind of preparation.

Rehabilitation centers; organizations and schools for the blind, deaf, dyslectic, disabled, and the mentally handicapped; and publishers and manufacturers of special instructional materials, aids, and equipment can offer aid in meeting unique needs. Consultation with special education personnel and rehabilitation counselors is a good starting point. The student should also be asked to make suggestions.

Care should be taken to insure occupational competency. Prospective employers should be shown how the modification operates in the work setting and how it increases efficiency.

The previously described list of strategies is not exhaustive. Others may be added. All will need to be directed toward the occupation for which training is being given, the students enrolled, the availability of instructional materials, and the community. It is also important to remember that what works well for one group of students or a particular student will not necessarily work well for another.

Practical Arts

TRANSPORTATION EXPLORATION

TASK: IDENTIFYING ENERGY SOURCES

INTRODUCTION

All power systems must have a source of energy. There are many forms of energy. In this task assignment sheet, you will become familiar with the basic sources of energy.

OBJECTIVE

GIVEN a list of energy sources and a description of each,

MATCH THE ENERGY SOURCE WITH ITS DESCRIPTION.

YOU should match at least 90% of the energy sources correctly.

LEARNING ACTIVITIES

1. READ and DISCUSS Instruction Sheet I, SOURCES OF ENERGY.
2. LIST several energy converters, such as the electric light. BRING a picture of or an actual energy converter to class.
3. REPORT how energy is used in one of the following: home, school, industry, transportation, recreation.
4. DISCUSS the importance of conserving energy. MAKE a poster or bulletin board display on a way to conserve energy.
5. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

Your teacher will provide a test on sources of energy. Complete the test.

Kentucky Department of Education
Raymond Barber, Superintendent of Public Instruction
1982-83

VOCABULARY

Atom - a tiny particle of anything.

Conserve - to keep from loss or from being used up.

Convert - to change.

Electron - negatively charged particles that form a part of all atoms.

Energy - ability for doing work.

Kinetic energy - energy in motion.

Molecule - the smallest particle into which a substance can be divided without chemical changes.

Potential energy - stored up energy.

The development of this material is the result of a cooperative effort between the Bureau of Vocational Education and the Office of Research and Planning, Kentucky Department of Education. The Kentucky Department of Education does not discriminate on the basis of race, color, national origin, age, religion, marital status, sex or handicap. This publication was printed with state funds.

INSTRUCTION SHEET I

FORMS OF ENERGY

Below are the basic forms of potential energy and kinetic energy:

Heat energy: vibration of molecules. Most machines are operated through some form of heat energy.

Mechanical energy: energy of motion; for instance, a rapidly moving object strikes another object and sets up a reaction.

Electrical energy: vibration of particles of matter which are transmitted through the air or solid objects, such as a telephone cable.

Chemical energy: chemical action between molecules. Fossil fuels, such as coal and petroleum, are a form of chemical energy.

Atomic energy: fusion (melting together) or fission (splitting apart) of atoms.

Solar energy: considered as heat, radiant (sending out rays of light), and atomic energy. It is a basic energy source; for example, coal and petroleum were formed years ago from plants and animals which lived and stored the sun's energy. The results of solar energy are:

--water
--air
--plants
--heat

INSTRUCTOR'S FINAL CHECKLIST

IDENTIFYING ENERGY SOURCES

Accomplished	Not Accomplished

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

The student matched at least 90% of the energy sources with the correct description ..... [ ] [ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: IDENTIFYING SIMPLE MACHINES

INTRODUCTION

Simple machines are the building blocks of mechanical power systems. They are used to produce a change in force, distance, and direction. In this task assignment sheet, you will become familiar with the basic simple machines.

OBJECTIVES

LIST AT LEAST FIVE SIMPLE MACHINES.

LEARNING ACTIVITIES

1. READ about the lever principle. DEFINE first-, second-, and third-class levers. Your teacher will provide a reference.

2. READ about simple machines that operate on the lever principle. DISCUSS the information. Your teacher will provide a reference.

3. LOOK AT simple machines that operate on the lever principle. Your teacher will show them to you.

4. READ about inclined planes. DISCUSS the information. Your teacher will provide a reference.

5. LOOK AT simple machines that are inclined planes. Your teacher will show them to you.

6. EXAMINE a bicycle, and LIST the simple machines used.

7. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

List at least five simple machines.

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VOCABULARY

Mechanical advantage - the cause of a change in force, direction, or distance.

Simple machine - a device that has a mechanical advantage.

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INSTRUCTOR'S FINAL CHECKLIST

IDENTIFYING SIMPLE MACHINES

Accomplished	Not Accomplished

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

The student listed at least five simple machines ..... [ ] [ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: DEMONSTRATING USE OF SIMPLE MACHINES

INTRODUCTION

A simple machine causes a change in force, direction, or distance. In this task assignment sheet, you will demonstrate how a simple machine brings about one or more of these changes.

OBJECTIVE

GIVEN a simple machine used in transportation,

DEMONSTRATE ITS USE.

YOU should demonstrate how the machine works and explain what change it causes.

LEARNING ACTIVITIES

1. LOOK AT illustrations of simple machines in action,

   AND/OR

   WATCH your teacher demonstrate how simple machines are used.

2. SELECT a simple machine. STUDY how it works, and FIND OUT whether it causes a change in force, direction, or distance.

3. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

Demonstrate the use of the simple machine you selected in Learning Activity 2. Explain whether it causes a change in force, direction or distance.

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INSTRUCTOR'S FINAL CHECKLIST

DEMONSTRATING USE OF SIMPLE MACHINES

Accomplished	Not Accomplished

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

In demonstrating the use of a simple machine, the student:

1. Demonstrated how the machine works ..... [ ] [ ]
2. Explained whether it causes a change in force, direction, or distance ..... [ ] [ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: IDENTIFY ADVANTAGES AND DISADVANTAGES OF FRICTION

INTRODUCTION

When we slide one object over the surface of another, no matter how smooth they appear to be, there is a force that resists the movement. This force is called "friction." Friction may be helpful or harmful in a number of ways. In this task assignment sheet, you will learn both advantages and disadvantages of friction.

OBJECTIVES

(1) LIST AT LEAST THREE ADVANTAGES AND THREE DISADVANTAGES OF FRICTION.

(2) USING two objects,

DEMONSTRATE A USEFUL OR A HARMFUL EFFECT OF FRICTION.

YOUR performance will be rated in accordance with the Instructor's Final Checklist.

LEARNING ACTIVITIES

1. LISTEN and WATCH as your teacher explains and demonstrates the three causes of friction. EXPERIMENT with several types of materials by rubbing them together, and NOTICE the amount of resistance of each.
2. WATCH as your teacher demonstrates how friction can be useful in stopping an object, providing pulling power (traction), and preventing slipping. LIST several examples of the usefulness of friction. DISCUSS your examples in class.
3. WATCH as your teacher demonstrates a harmful effect of friction. LIST several examples of harmful effects of friction. DISCUSS your examples in class.
4. ARRANGE with your instructor to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

(1) List at least three advantages and three disadvantages of friction.

(2) Demonstrate a useful or a harmful effect of friction.

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INSTRUCTOR'S FINAL CHECKLIST

IDENTIFY ADVANTAGES AND DISADVANTAGES OF FRICTION

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

	Accomplished	Not Accomplished
1. The student listed at least three advantages and three disadvantages of friction.....	[ ]	[ ]
2. In demonstrating a useful or a harmful effect of friction, the student:		
a. Brought two objects into contact.....	[ ]	[ ]
b. Called attention to the resistance caused by friction.....	[ ]	[ ]
c. Explained whether the friction is useful or harmful.....	[ ]	[ ]
d. Explained why the friction is useful or harmful.....	[ ]	[ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: USE LUBRICANTS TO OVERCOME FRICTION

INTRODUCTION

The harmful effects of friction can often be overcome. If two sliding objects are separated by rollers, the resistance would be greatly reduced. In transportation, though, resistance is more frequently reduced through the use of lubricants. In this task assignment sheet, you will become familiar with several types of lubricants and will discover how they overcome friction.

OBJECTIVE

GIVEN two objects,

USE A LUBRICANT TO OVERCOME FRICTION.

YOUR lubricated objects should be smooth and slippery and move easily.

LEARNING ACTIVITIES

1. EXAMINE several types of lubricants. Your teacher will display them.
2. WATCH and LISTEN as your teacher explains and demonstrates how lubricants effect friction. PRACTICE lubricating two objects.
3. CHOOSE a lubricant and two objects to use in a demonstration.
4. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

Move together the two objects you chose in Learning Activity 3 to demonstrate the amount of friction present. Then apply the lubricant and move the objects together again.

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VOCABULARY

Lubricant - a substance used for putting on parts of machines, that slide or move against one another, to make them smooth and slippery so that they will work easily.

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INSTRUCTOR'S FINAL CHECKLIST

USE LUBRICANTS TO OVERCOME FRICTION

The student should be evaluated according to the performance ratings in the box. Indicate on a separate sheet of paper whether the student's performance for each item is Fully Accomplished, Partially Accomplished, Not Accomplished, or under certain circumstances, Not Applicable.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and instructor will decide which learning activities must be repeated.

Fully Accomplished	Partially Accomplished	Not Accomplished	Not Applicable

The student's lubricated objects were:

a. Smooth	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
b. Slippery	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
c. Easily moved	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: IDENTIFYING BASIC SYSTEMS OF A SMALL FOUR-CYCLE ENGINE

INTRODUCTION

Small engines are used to power much of our equipment and many of our machines today. They range in power from one-half horsepower to about 15 horsepower. From time to time, these engines become in need of repair. In order to identify the source of the problem, it is necessary for the worker who repairs the engine to be familiar with its basic systems. In this task assignment sheet, you will learn to identify the basic systems of a four-cycle engine.

OBJECTIVE

GIVEN a small four-cycle engine,

REPORT ON ONE OF THE SYSTEMS.

YOUR REPORT should identify the system and explain the function of each part correctly.

LEARNING ACTIVITIES

1. LISTEN to your teacher explain how a four-cycle engine works.

2. LOOK AT the parts of an ignition system. READ about or LISTEN to your teacher explain the function of the system and how it works. PARTICIPATE in a class discussion.

3. LOOK AT the parts of a cooling system. READ about or LISTEN to your teacher explain the function of the system and how it works. PARTICIPATE in a class discussion.

4. LOOK AT the parts of a lubricating system. READ about or LISTEN to your teacher explain the function of the system and how it works. PARTICIPATE in a class discussion.

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LEARNING ACTIVITIES (Continued)

5. LOOK AT the parts of a fuel system. READ about or LISTEN to your teacher explain the function of the system and how it works. PARTICIPATE in a class discussion.

6. LOOK AT the parts of an exhaust system. READ about or LISTEN to your teacher explain the function of the system and how it works. PARTICIPATE in a class discussion.

7. SELECT one of the systems discussed. IDENTIFY each part of the system and STUDY its function.

8. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

Make a report on the system you chose in Learning Activity 7. Identify the system and explain the function of each part.

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VOCABULARY

Engine system - a set of parts that forms one of the essential operations of the engine.

Four-cycle - an engine that requires four basic operations in order to run.

Horsepower - a unit for measuring the power of an engine. One horsepower equals 550-foot-pounds per second. A foot-pound equals the work of raising one pound one foot.

INSTRUCTOR'S FINAL CHECKLIST

IDENTIFYING BASIC SYSTEMS OF A FOUR-CYCLE ENGINE

Accomplished	Not Accomplished

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

In reporting on one of the basic systems of a four-cycle engine, the student:

1. Identified system..... [ ] [ ]
2. Explained the function of each part correctly..... [ ] [ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: IDENTIFYING TOOLS USED IN MAINTAINING ENGINES

INTPODUCTION

To maintain an engine means to keep it running smoothly. This requires the use of a number of tools. In this task assignment sheet, you will learn to identify the tools used to work on a small engine.

OBJECTIVE

GIVEN a display of tools used to work on a small engine,

IDENTIFY EACH TOOL.

YOU SHOULD identify at least 90% of the tools correctly.

LEARNING ACTIVITIES

1. LOOK AT a display of tools used in maintaining a small engine. LISTEN and OBSERVE as your teacher describes the tools and explains their functions. EXAMINE the tools.

2. MAKE a display or a poster showing tools used in one of the following operations:

   --Disassemble an engine.
   --Measure and evaluate the parts and conditions of an engine.
   --Reassemble an engine.
   --Test run an engine.
   --Make external adjustments on an engine.

   WORK with a group of classmates. Your teacher will provide a tool list for each operation. SHARE your work in class.

3. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

Your teacher will provide a display of tools used to work on small engines. Name the tools.

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INSTRUCTOR'S FINAL CHECKLIST

IDENTIFYING TOOLS USED IN MAINTAINING ENGINES

	Accomplished	Not Accomplished
Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.		
The student identified 90% of the tools correctly.....	[ ]	[ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: DISASSEMBLING A TWO- OR FOUR-CYCLE ENGINE

INTRODUCTION

Engines sometimes have to be disassembled (taken apart) in order to be repaired. In this task assignment sheet, you will learn how to disassemble an engine.

OBJECTIVE

GIVEN a small engine, the service manual, and the appropriate mallets, pliers, screwdrivers, sockets, wrenches, vise, and special tools,

DISASSEMBLE THE ENGINE.

YOU SHOULD follow each step outlined in the manual.

LEARNING ACTIVITIES

1. REVIEW the major parts of a small engine.
2. REVIEW the types of tools that are used to disassemble a small engine.
3. STUDY illustrations and READ about disassembling a small engine. Your teacher will provide a reference. DISCUSS the information.
4. WATCH a demonstration of a small engine being disassembled.
5. PRACTICE disassembling a small engine.
6. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

You will be provided a small engine and the necessary tools. Disassemble the engine.

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INSTRUCTOR'S FINAL CHECKLIST

DISASSEMBLING A TWO- OR FOUR-CYCLE ENGINE

Accomplished	Not Accomplished

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

In disassembling a small engine, the student followed the steps outlined in the service manual ..... [ ] [ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: MEASURE AND EVALUATE PARTS AND THE CONDITION OF A SMALL ENGINE

INTRODUCTION

Often before an engine can be repaired, the condition of the parts must be evaluated. In this task assignment sheet, you will learn how to measure and evaluate the parts and condition of an engine.

OBJECTIVE

GIVEN a disassembled engine, machinist vise, micrometers, and gauges,

MEASURE AND EVALUATE THE PARTS AND CONDITION OF THE ENGINE.

YOUR WORK will be rated in accordance with the Instructor's Final Checklist.

LEARNING ACTIVITIES

1. REVIEW the tools used to measure and evaluate the parts and condition of an engine.
2. EXAMINE the parts of the engine to be measured and evaluated. Your teacher will show them to you.
3. WATCH a demonstration of each part being measured and evaluated. PRACTICE measuring and evaluating each part. Your teacher will help you.
4. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

Your teacher will provide the necessary tools. Measure and evaluate the parts and condition of the disassembled engine.

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INSTRUCTOR'S FINAL CHECKLIST

MEASURE AND EVALUATE PARTS AND THE CONDITION OF A SMALL ENGINE

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

	Accomplished	Not Accomplished
In measuring and evaluating parts and the condition of the engine, the student:		
1. Measured the crankshaft journals	[ ]	[ ]
2. Measured the engine cylinder bore	[ ]	[ ]
3. Measured the piston skirt diameter	[ ]	[ ]
4. Serviced the air filter	[ ]	[ ]
5. Gapped and installed a spark plug	[ ]	[ ]
6. Installed and adjusted the points	[ ]	[ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: REASSEMBLING A TWO- OR FOUR-CYCLE ENGINE

INTRODUCTION

After the parts of a disassembled engine have been measured and evaluated and the necessary adjustments have been made, the engine must be reassembled (put back together). In this task assignment sheet, you will learn how to reassemble a small engine.

OBJECTIVE

GIVEN a disassembled two- or four-cycle engine and the necessary tools and equipment,

REASSEMBLE THE ENGINE.

THE REASSEMBLED ENGINE will be rated in accordance with the Instructor's Final Checklist.

LEARNING ACTIVITIES

1. REVIEW the tools used to reassemble a small engine.
2. REVIEW the parts of the engine that are to be reassembled.
3. WATCH a demonstration of how to reassemble each part of the engine.
4. PRACTICE reassembling the engine. Your teacher will help you.
5. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

Your teacher will provide the necessary tools and equipment. Reassemble the engine.

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INSTRUCTOR'S FINAL CHECKLIST

REASSEMBLING A TWO- OR FOUR-CYCLE ENGINE

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

	Accomplished	Not Accomplished
The reassembled engine met the following standards:		
1. All parts fit together in correct location	[ ]	[ ]
2. All nuts and bolts were tightened to the correct specifications	[ ]	[ ]
3. When rotated by hand, the engine went through a complete cycle with no binding	[ ]	[ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: TEST RUNNING A TWO- OR FOUR-CYCLE ENGINE

INTRODUCTION

After a mechanic has worked on an engine, he/she gives it a test run to determine whether or not it runs properly. In this task assignment sheet, you will learn how to test run a small engine.

OBJECTIVE

GIVEN a reassembled two- or four-cycle engine in a well ventilated shop area, the necessary tools and equipment, and a troubleshooting guide,

TEST RUN THE ENGINE.

YOUR WORK will be rated in accordance with the Instructor's Final Checklist.

LEARNING ACTIVITIES

1. READ about starting an engine. Your teacher will provide a reference. DISCUSS the information.

2. WATCH a demonstration on how to start an engine. PRACTICE the procedure.

3. READ about operating an engine. Your teacher will provide a reference. DISCUSS the information.

4. EXAMINE a troubleshooting guide. Your teacher will provide a copy.

5. READ about stopping an engine. Your teacher will provide a reference. DISCUSS the information.

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LEARNING ACTIVITIES (Continued)

6. PRACTICE operating and stopping the engine. REFER to the troubleshooting guide, if necessary.

7. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

Your teacher will provide the necessary tools and equipment and a trouble-shooting guide. Test run the engine in the shop area.

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INSTRUCTOR'S FINAL CHECKLIST

TEST RUNNING A TWO- OR FOUR-CYCLE ENGINE

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

Accomplished	Not Accomplished

In test running a small engine, the student:

1. Started the engine in the proper manner ..... [ ] [ ]
2. Operated the engine in the proper manner ..... [ ] [ ]
3. Identified any engine problems that existed ..... [ ] [ ]
4. Stopped the engine in the proper manner ..... [ ] [ ]
5. Observed the safety rules ..... [ ] [ ]

Practical Arts

TRANSPORTATION EXPLORATION

TASK: MAKING EXTERNAL ADJUSTMENTS ON A SMALL ENGINE

INTRODUCTION

In order to run efficiently, a small engine may need some adjustments after it has been reassembled. In this task assignment sheet, you will learn how to make external adjustments.

OBJECTIVE

GIVEN a small engine with external problems, procedures for making the adjustments, and the necessary tools and safety equipment,

MAKE THE ADJUSTMENTS.

THE ADJUSTED ENGINE should start easily and run smoothly and efficiently.

LEARNING ACTIVITIES

1. IDENTIFY the adjustments needed on a small engine provided by your teacher.

2. LOOK UP the procedures for making the necessary adjustments. Your teacher will provide a reference. IDENTIFY the part or parts to be adjusted and the tools necessary to make the adjustments.

3. ARRANGE with your teacher to complete this task by going through the CHECK-OUT ACTIVITY.

CHECK-OUT ACTIVITY

You will be provided the engine and necessary tools and equipment.

Make the external adjustments you identified in Learning Activity 1. You may refer to the procedures for making the adjustments.

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INSTRUCTOR'S FINAL CHECKLIST

MAKING EXTERNAL ADJUSTMENTS ON A SMALL ENGINE

Performance Level: All items must receive a rating of ACCOMPLISHED. If any items are rated NOT ACCOMPLISHED, the student and the instructor will decide if any learning activities must be repeated.

	Accomplished	Not Accomplished
The adjusted engine:		
1. Started easily.....	[ ]	[ ]
2. Ran smoothly and efficiently.....	[ ]	[ ]